Soyuz 11 Return Samples: Assessment of Air Quality Aboard the International Space Station

The toxicological assessments of 6 dual sorbent tubes (DSTs) and 10 pairs of formaldehyde badges returned aboard Soyuz 11 on April 9, 2006 are reported. Analytical methods have not changed from earlier reports. The recoveries of the 2 less volatile surrogates from the 6 DSTs averaged 88 and 80 %; however, ^{13}C-acetone was only recovered at an average of 49 %. Historically-derived correction factors were applied to volatile polar compounds due to limited recoveries by the DSTs. Formaldehyde recoveries from 2 positive controls were 102 and 92 %.

The two general criteria used to assess air quality are the total-non-methane-volatile organic hydrocarbons (NMVOCs) and the total T-value (minus the CO_2 and formaldehyde contributions). Control of atmospheric alcohols is important to the water recovery system engineers, hence total alcohols (including acetone) are also shown for each sample. Because formaldehyde is quantified from sorbent badges, its concentration is also listed separately. These four indices of air quality are summarized below:

Module/Sample	Approx. Date	NMVOCs (mg/m^3)	T Value (units)	Alcohols[2] (mg/m^3)	Formaldehyde (ug/m^3)
Lab/Form.	10/26/05	--	--	--	37
SM/Form.	10/26/05	--	--	--	26
Lab/Form.	11/24/05	--	--	--	24
SM/Form.	11/24/05	--	--	--	14
FGB/DST	12/21/05	5	0.6	4	--
Lab/DST&Form.	12/21/05	7	0.6	5	28
SM/Form.	12/21/05	--	--	--	26
Lab/DST&Form.	02/21/06	11	0.8	8	33
SM/DST&Form.	02/21/06	11	0.8	8	22
Lab/DST&Form.	3/29/06	12	0.7	10	30
SM/Form.	3/29/06	--	--	--	28
FGB/DST	3/29/06	10	0.7	8	--
Guideline		*<25*	*<1.0*	*<5*	*<120*[1]

[1] A new long-term SMAC has been provisionally accepted by the National Research Council Committee on Toxicology and by the NASA Toxicology Group.
[2] Ethanol contributed primarily to these values.

All formaldehyde concentrations were well within the new long-term SMAC guideline of 120 ug/m3, and the Lab samples continue to show slightly higher formaldehyde concentrations than the SM samples. There is nothing in these data to suggest that air quality has degraded within the ISS during the time period of the sampling.

Enclosures

Table 1: Analytical Concentrations of 11S DST Air Samples
Table 2: T-Value Calculations of 11S DST Air Samples